JUN 20 1991

POSSIBLE REQUIREMENTS OF THE GROUND-WATER DISINFECTION RULE

The purpose of this document is to present possible ground-water disinfection requirements and to solicit feedback from the public.

The document consists of two sections: 1) Ground-Water Disinfection Draft Rule Criteria, and 2) Rationale for the Ground-Water Disinfection Draft Rule Criteria. The Draft Rule Criteria section (sometimes referred to as the Draft Rule Criteria document) specifies a set of possible requirements for the Ground-Water Disinfection Rule (GWDR). In some cases, variations are presented as alternate requirements. The Rationale section describes the purpose and structure of the rule, and provides a brief explanation of some of the outstanding issues raised in the Draft Rule Criteria section.

EPA anticipates adhering to the following schedule in developing this rule:

- Agency approval of intent and scope of rule: December 1991
- Distribute draft rule to interested public: February 1992
- Propose rule: June 1993
- Promulgate rule: June 1995

The information contained herein has not undergone formal Agency review. It is meant to elicit thoughts and information from the public to assist EPA in development of the rule. EPA solicits comment on all the information and criteria described herein. All comments received by October 15, 1991 will be considered in the development of the Draft Rule. Comments received after November 15, 1991 will be considered in the development of the Proposed Rule. Comments should be sent to:

Stig Regli - GWDR
OGWDW (WH-550D)
USEPA
401 M Street, SW
Washington, DC 20460

JUN 6 1991

GROUND-WATER DISINFECTION
DRAFT RULE CRITERIA

I. Background

* The 1986 SDWA amendments mandate EPA to promulgate disinfection requirements including variance criteria for all public water supplies. In June 1989, EPA promulgated disinfection requirements for surface supplies and ground water under the direct influence of surface water. EPA must now propose and promulgate disinfection requirements for ground water not under the direct influence of surface water to fulfill the statutory requirement.

* A "strawman rule" with regulatory options was presented at a public meeting on June 21, 1990.

* Proposal is planned for 1993 and promulgation is planned for 1995 (same schedule as Disinfectants and Disinfection By-Products Rule).

II. General Requirements

* Source Water Disinfection Requirements:

  Community and Noncommunity Systems: A public water system using ground water must disinfect the source water of each of its wells unless:

  (a) one (or more) of the system's wells meets "natural disinfection" criteria, in which case, the system is not required to disinfect that well, or

  (b) the system qualifies for a variance under Section 1415 (a)(1)(B) of the SDWA, in which case, source water disinfection for the pertinent well is not required.

  Both of these conditions are intended to reflect those situations where source water is not vulnerable to viral contamination.

* Distribution System Disinfection Requirements:

  Community Systems: Each system must disinfect the distribution system continuously and maintain a detectable disinfectant residual or an HPC concentration of <500/ml in the water within the distribution system unless the State determines that the distribution system is not vulnerable to external contamination or significant bacterial growth.

Noncommunity Systems: Each system is not required to disinfect its distribution system unless the State determines that the distribution system is vulnerable to external contamination or significant bacterial growth.

[Alternate:
Community Systems, and Noncommunity Systems Having at Least 15 Service Connections: Each system must disinfect the distribution system continuously and maintain a detectable disinfectant residual or an HPC concentration of <500/ml in the water within the distribution system unless the State determines that the distribution system is not vulnerable to external contamination or significant bacterial growth.

Noncommunity Systems Having Fewer Than 15 Service Connections: Each system is not required to disinfect its distribution system unless the State determines that the distribution system is vulnerable to external contamination or significant bacterial growth.]

* Qualified Operators:

All systems required to disinfect their source water must be operated by qualified operators as determined by the State.

[Alternate: Require all systems, regardless of whether they disinfect, to be operated by qualified operators as determined by the State.]

* Treatment technique requirements are established in lieu of MCLs for viruses, heterotrophic plate count bacteria (HPC), and *Legionella*. *[The issue of whether to include coverage for* Legionella *in this rule is unresolved.]*

* Maximum Contaminant Level Goals:

Contaminant	MCLG
Viruses	0
HPC	none
Legionella [if included]	0

III. "Natural Disinfection" Criteria and Associated Conditions to Be Met to Avoid Source Water Disinfection

A) Natural Disinfection Criteria

A well can qualify as having "natural disinfection" if the Primacy Agency determines that at least one of the following criteria are met (in addition to all conditions under "B" below). The system must submit a report to the State that will assist the State in making this determination (see Reporting Requirements). EPA will provide guidance for making these determinations.

* The nearest potential source of fecal contamination must be at least "a" meters from the well (surface water must be considered as a potential contaminant source), and flow through caves, large fractures, or other similar features does not occur.

* The travel time of a ground-water particle (not considering the effects of retardation, dispersion, or diffusion) taking the most direct path must be at least "x" days from the nearest potential source of fecal contamination to the receptor well.

* The travel time of a microbial pathogen (including the effects of retardation, dispersion, and diffusion) taking the most direct path must be at least "y" days from the nearest potential source of fecal contamination to the receptor well.

* A hydrogeologic feature such as a thick confining layer or a thick unsaturated zone controls potential contaminant flow to the well, and the integrity of the feature is little affected by anthropogenic activities.

B) Associated Conditions

In addition to meeting one criterion above, all of the following conditions must be met for a well to qualify as having "natural disinfection":

* The well must not have been identified as a source of a waterborne disease outbreak, or if so identified, either the well must have been modified to prevent another such occurrence as determined by the State, or source water contamination must have been ruled out as a cause of the outbreak.

* The well must meet State-approved well construction codes.

* The system must not have violated the Total Coliforms Rule unless:

  (a) the State determines the violation is not due to negligence, and

  (b) the cause of the violation has been identified and alleviated.

IV. Disinfection Requirements

Source Water Disinfection Requirements

If source water disinfection is required:

* Disinfection treatment (or other process approved by the State) of each well in the system must achieve at least "x"% inactivation and/or removal of viruses. Each well must meet design and operating conditions specified by the State to ensure that this level of inactivation is achieved. EPA will provide guidance to States for specifying design and operating conditions for each well. Applications of the CT concept will be promoted. *[Level of inactivation--unresolved. Our intention is to base the level of inactivation on virus survey data and risk analysis of contaminated supplies. Level will be set to ensure high probabilities that most systems will not exceed an acceptable risk level from drinking water consumption (e.g., <1 infection per 10,000 people per year).]*

  [Alternate: Allow the State to set the levels of inactivation and/or removal of viruses by disinfection treatment (or other process approved by the State) on a case-by-case basis.]

* Systems not disinfecting their well(s) with ultraviolet light must, for each well, maintain a disinfectant residual concentration of at least 0.2 mg/l in the water entering the distribution system. Systems with wells serving greater than 3,300 people must demonstrate this by continuous monitoring at those wells. If there is a failure in the continuous monitoring, the system may substitute grab sample monitoring every four hours for up to five days. Systems with wells serving 3,300 people or less may take grab samples in lieu of providing continuous monitoring at those wells on an ongoing basis at the frequency of one sample per day per well. If a system uses grab sampling in lieu of continuous monitoring, any time the residual falls below 0.2 mg/l, the system

must conduct grab sample monitoring every four hours until the residual is restored. If the disinfectant residual falls below 0.2 mg/l for more than four hours at any well, the system must notify the State as soon as possible but no later than the end of the next business day.

* Systems disinfecting with ultraviolet light must use a sensor and recorder at each well to indicate that the dosage is not less than "y" mW-sec/cm^2 for more than four hours. If there is a failure in the monitoring equipment, the system must stop the delivery of water from the well(s) to the distribution system until the monitoring equipment is again operative. Any time the ultraviolet dosage is less than "y" mW-sec/cm^2 for more than four hours at a well, the system must notify the State as soon as possible but no later than the end of the next business day.

Distribution System Disinfection Requirements

Community Systems

* Unless the State determines that the distribution system is not vulnerable to external contamination or significant bacterial growth, disinfection of the distribution system must be continuous, and disinfectant residuals in the distribution system cannot be undetectable ***[definition of detectable residual to be determined]*** or HPC levels cannot be greater than 500/ml in more than five percent of the samples each month for any two consecutive months. Samples must be taken at least at the same time and at the same points in the distribution system as for total coliforms under the Total Coliforms Rule.

Noncommunity Systems

* Unless the State determines that the distribution system is vulnerable to significant bacterial growth or external contamination, noncommunity systems are not required to disinfect their distribution systems. If the State determines that the distribution system is vulnerable to such contamination, then the disinfection requirements for the distribution system are the same as for community systems.

[Alternate:
Community Systems, and Noncommunity Systems Having at Least 15 Service Connections

* ***Unless the State determines that the distribution***

system is not vulnerable to external contamination or significant bacterial growth, disinfection of the distribution system must be continuous, and disinfectant residuals in the distribution system cannot be undetectable [definition of detectable residual to be determined] or HPC levels cannot be greater than 500/ml in more than five percent of the samples each month for any two consecutive months. Samples must be taken at least at the same time and at the same points in the distribution system as for total coliforms under the Total Coliforms Rule.

Noncommunity Systems Having Fewer Than 15 Service Connections

* *Unless the State determines that the distribution system is vulnerable to significant bacterial growth or external contamination, these systems are not required to disinfect their distribution systems. If the State determines that the distribution system is vulnerable to such contamination, then the disinfection requirements for the distribution system are the same as for community systems, and noncommunity systems having at least 15 service connections.]*

V. Analytical Requirements

* Testing and sampling must be conducted in accordance with Standard Methods, 17th edition, or methods approved by EPA, for HPC and residual disinfectant concentration. Residuals of free chlorine and combined chlorine may also be measured by using DPD colorimetric test kits if approved by the State. Ozone residuals may also be measured using automated methods calibrated in reference to the results obtained by the standard method if approved by the State. Methods for measuring UV dosage must be approved by the State (EPA will provide guidelines for UV measurement). *[Guidance for UV methods being developed.]*

* Measurements for residual disinfectant concentration and UV dosage must be conducted by a party approved by the State. Measurements for HPC must be conducted by a laboratory certified by the State or EPA to do such analysis. (Until laboratory certification criteria are developed for the analysis of HPC, any laboratory certified by EPA for total coliforms analysis is deemed certified for HPC.)

VI. Reporting Requirements

* All parameters required in the rule must be reported monthly to the State.

* Systems meeting criteria for variances or "natural disinfection" must notify the State when any of the criteria or associated conditions are no longer being met.

* Within 18 months after promulgation of the rule, all systems seeking avoidance of source water disinfection must submit a report to the State that specifies the process and criteria by which the system proposes to avoid source water disinfection. The report must:

  (a) propose that the system qualifies for either "natural disinfection" or a variance, and

  (b) include site-specific information that supports the proposal in (a). ***[Which parameters would be required to be reported for each of the four "natural disinfection" criteria is under development.]***

  The report will be used by the State, along with any additional data provided by the system, to evaluate whether the system meets "natural disinfection" or variance criteria. Other available information about the site, region, and/or aquifer may be used by the State in making the determination. ***[The specific methods utilized by the State and the data required to make these determinations is under development.]***

VII. Compliance

* All community systems must meet monitoring and performance requirements within 18 months and 36 months, respectively, after promulgation of the rule. All noncommunity systems must meet monitoring and performance requirements within 36 months and 72 months, respectively, after promulgation of the rule.

VIII. Variances

* Variances from source water disinfection requirements are allowed for each well. A well that does not qualify for "natural disinfection" may still qualify for a variance. The system must submit a report to the State that will assist the State in making this

determination (see Reporting Requirements). The site-specific information and analysis required for a variance are more rigorous than that required to qualify for "natural disinfection."

* The State must provide notice and opportunity for public hearing on each proposed variance. A notice and public hearing may cover the granting of more than one variance at a time.

* Variance criteria to be met to avoid source water disinfection:

  - A sanitary survey that includes a more specific analysis of site hydrogeology than is required to meet the "natural disinfection" criteria is conducted (guidance to be developed) and the results indicate that the source water of the well is not vulnerable to fecal contamination. *[Frequency of sanitary survey--unresolved. The June 21, 1990 "strawman" variance criteria specified a sanitary survey frequency of every five years, which was consistent with the frequency of sanitary surveys required under the Total Coliforms Rule for ground-water systems collecting fewer than five samples per month. EPA is considering amending the Total Coliforms Rule to require a sanitary survey frequency that is consistent with the 3-6-9 cycle of the Standardized Monitoring Framework. EPA intends to require a sanitary survey frequency that would be consistent with the Total Coliforms Rule.]*

  - The well must not have been identified as a source of a waterborne disease outbreak, or if so identified, either the well must have been modified to prevent another such occurrence as determined by the State, or source water contamination must have been ruled out as a cause of the outbreak.

  - The well must meet State-approved well construction codes.

  - The system must not have violated the Total Coliforms Rule unless:

    (a) the State determines the violation is not due to negligence, and

    (b) the cause of the violation has been identified and alleviated.

IX. Exemptions

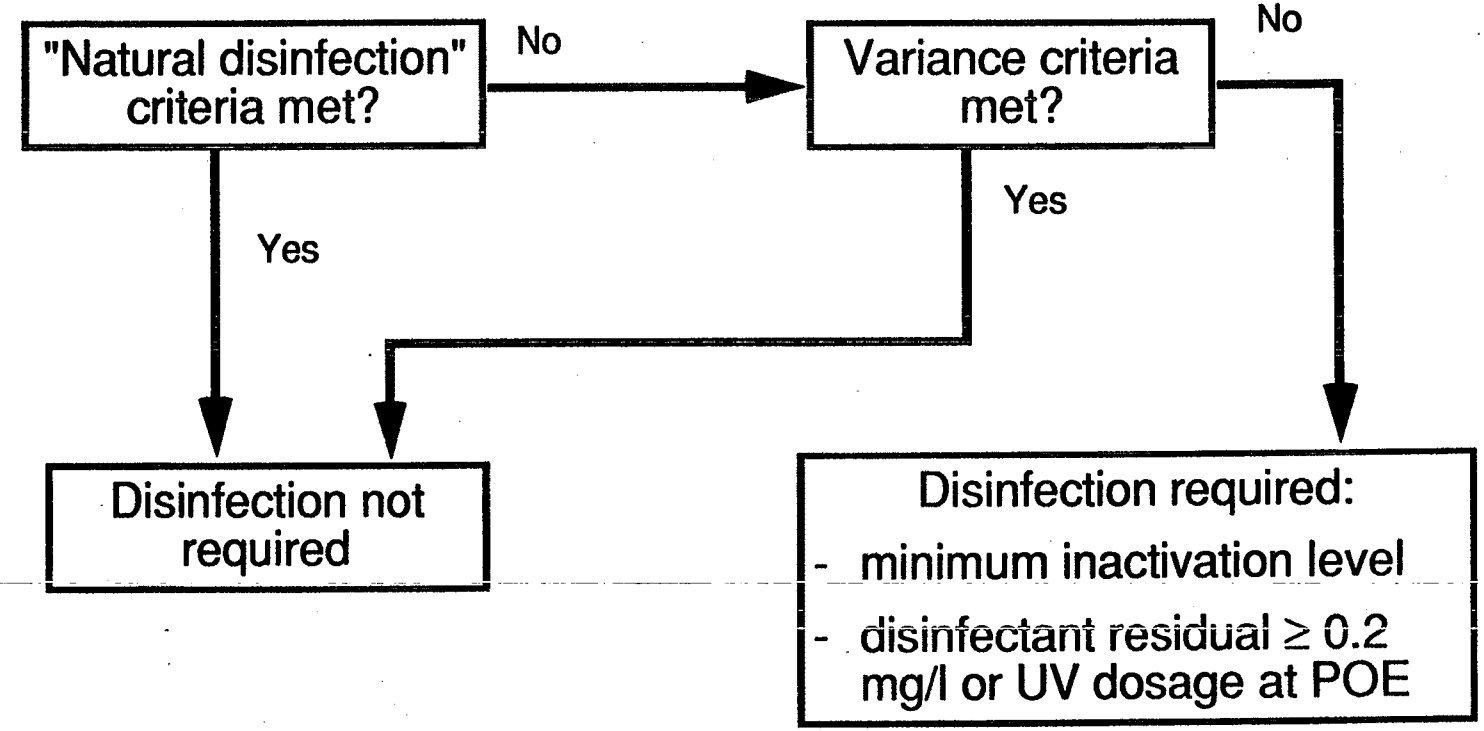
* Exemptions are allowed provided the following criteria are met:

  - System is unable to comply with the rule due to compelling factors (which may include economic factors).

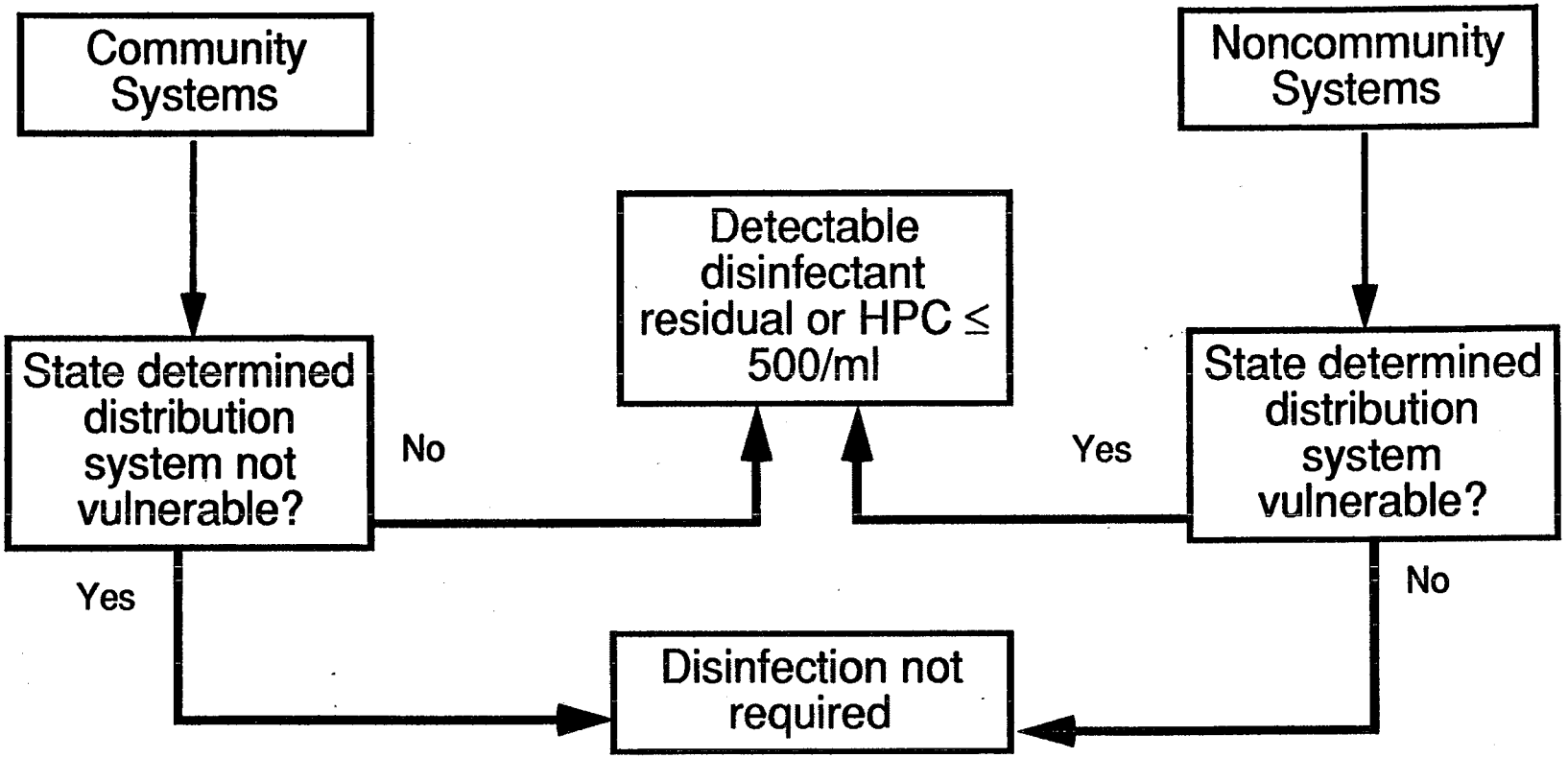
  - System is in operation on the effective date of the rule, or if not, no alternative source of drinking water is available.

  - Granting of the exemption will not result in an unreasonable risk to health.

SOURCE WATER DISINFECTION REQUIREMENTS



DISTRIBUTION SYSTEM DISINFECTION REQUIREMENTS



Rationale for the Ground-Water Disinfection Draft Rule Criteria

Introduction and Purpose: The purpose of the Draft Rule Criteria is to present EPA's current thinking on possible ground-water disinfection requirements and to solicit feedback from the public. The Draft Rule Criteria document is a brief description of the evolving criteria under consideration for publication in the Federal Register in June 1993 as the proposed Ground-Water Disinfection Rule (GWDR).

In developing the Draft Rule Criteria, EPA considered public comments on draft regulatory options presented to the public in mid-1990 (the "strawman" rule). Since EPA continues to gather information and solicit public comments for use in development of the GWDR, the criteria may significantly change by the time the rule is proposed.

Format: Outstanding issues considered unresolved at this time have been highlighted with italics and brackets in the Draft Rule Criteria document. Several of the problematic issues are briefly explained in this Rationale.

Purpose of the GWDR: The purpose of the disinfection requirements will be to:

(1) Fulfill the Safe Drinking Water Act (SDWA) requirement that EPA promulgate disinfection requirements for all public water systems, and

(2) Correct deficiencies in water treatment by public water systems using ground water not under the direct influence of surface water believed to be responsible for waterborne disease outbreaks and waterborne endemic disease. Three microorganisms required to be regulated under the SDWA would be controlled: viruses, heterotrophic plate count bacteria (HPC), and *Legionella* (if it is shown to occur in the ground waters subject to this rule). Potential deficiencies in water treatment include no disinfection treatment when a system is vulnerable to contamination, inadequate disinfection, interrupted disinfection, and distribution system defects.

EPA promulgated disinfection requirements for public water systems using surface water or ground water under the direct influence of surface water on June 19, 1989. Those requirements are sometimes referred to as the Surface Water Treatment Rule (SWTR). The GWDR will apply to public water systems using ground water not under the direct influence of surface water and will complete the statutory requirements that all public water systems be required to disinfect.

Each component of the disinfection requirements presented is meant to correspond to a possible treatment deficiency within a public water system. As explained below under "Structure of the Rule," unless certain conditions are met, many systems using ground water will be required to apply disinfection treatment if they have not done so already. The minimum level of disinfection (not yet determined) is to ensure adequate inactivation of any viruses or bacteria in the source waters of systems considered vulnerable to such contamination. The requirement to maintain either a certain amount of disinfectant residual or a certain ultraviolet (UV) dosage at the entry point to the distribution system is to ensure continuity of disinfection (i.e., prevent interruptions of disinfection treatment) for the water entering the distribution system. The requirement to maintain a detectable disinfectant residual or a certain level of HPC in the distribution system is to ensure continuity of disinfection throughout the distribution system, high probability that there are no failures in the distribution system, and to minimize bacterial growth.

Structure of the Rule: The disinfection requirements are divided into source water requirements and distribution system requirements and are independent of one another. The main reason for this rule structure is to allow the requirements for disinfection to be more accurately matched to the need for disinfection. This rule structure should also prevent a significant number of systems from unnecessarily going through the variance process. For example, a system vulnerable to source water contamination but not vulnerable to distribution system contamination could avoid distribution system requirements based on State discretion rather than the variance process.

States consider the formal process of granting variances burdensome and would prefer use of different terminology, i.e., "criteria for avoiding disinfection," to circumvent this process; however, the definition of "variance" criteria for disinfection is a statutory requirement. The rule structure presented in the Draft Rule Criteria document is meant to lessen the State's burden, as it would allow certain classes of systems to avoid disinfection without going through the variance process.

Variances would be allowed only from source water disinfection. This is consistent with the SDWA requirements (Section 1415 (a)(1)(B)) that treatment technique variances can be based on "the nature of the raw water source" of the system.

Obtaining a variance would be one of two ways a system could avoid source water disinfection. The other possibility would be meeting "natural disinfection" criteria and associated conditions.

Avoidance of distribution system disinfection requirements would also be possible. The Draft Rule Criteria document presents two possible distribution system requirements:

(1) All community systems would have to disinfect unless the State determined that the distribution system is not vulnerable to external contamination or significant bacterial growth. The reverse would be true for noncommunity systems: noncommunity systems would not have to disinfect unless the State found the distribution system to be vulnerable to such contamination.

The alternate requirement specifies 15 service connections in noncommunity systems as the criterion for dividing systems into two categories:

(2) Community systems, and noncommunity systems having at least 15 service connections, would have to disinfect unless the State determined the distribution system is not vulnerable to external contamination or significant bacterial growth. Noncommunity systems with fewer than 15 service connections would not be required to disinfect unless the State found the distribution system to be vulnerable to such contamination.

EPA believes that most noncommunity distribution systems are very small and are unlikely to be determined vulnerable to external contamination or significant bacterial growth. Structuring the State decision making differently for noncommunity systems versus community systems would minimize transactional costs to States while also ensuring adequate protection in the distribution system. The alternate requirement would be more protective of the larger noncommunity systems.

"Natural Disinfection" Criteria: The specific aquifer and well characteristics that would allow a system to avoid source water disinfection without applying for a variance have not yet been fully developed. The criteria given in the Draft Rule Criteria document are preliminary and may change significantly in the process of rule development.

The rationale for introducing another method of estimating vulnerability (i.e., "natural disinfection" criteria) separate from variance criteria is to minimize transactional costs to States that must make decisions on whether systems can avoid disinfection.

One assumption underlying these criteria is that a system determined to be not vulnerable to enteric virus contamination in the source water will also be not vulnerable to enteric bacterial contamination. Survivability of enteric bacteria tends to be low as a result of sensitivity to environmental stress, and bacterial

transport through most aquifers is much more restricted than for enteric viruses.

Another assumption underlying these criteria is that the more a system knows about its configuration and proximity to potential contaminant sources, the more deserving the system is of meeting the criteria.

Many ground-water systems will have aquifer characteristics that clearly indicate the systems are not vulnerable to virus contamination at the wellhead. Examples include systems located far from contaminant sources, situations where travel times are long for water or viruses between the nearest contamination site(s) and the wellhead, and systems located in confined aquifers or in aquifers having thick overlying unsaturated zones. Other ground-water systems will have aquifer characteristics that less clearly indicate whether the systems are vulnerable to virus contamination. These systems will either apply for a variance or disinfect their source water.

The intent of introducing "natural disinfection" criteria is to establish conditions, which if met, would presume that the wellhead is not vulnerable to virus contamination. The proposed conceptual "natural disinfection" criteria (numerical boundaries are now being developed) allow several different methods for establishing nonvulnerability. The choice of method would depend upon the information available to the State.

The determination based on distance from contaminant source to well would be the most conservative choice due to the high uncertainty in the information on which the vulnerability judgment would be made. The determination of nonvulnerability based on travel time of water between the closest contamination site(s) and the wellhead would require more specific information (which should be readily available to most systems and/or States), represent a more accurate analysis, and therefore would be less conservative. The determination of nonvulnerability based on viral travel time would require still more specific information (which should be available to many systems and/or States) than that based on water travel time, represent a still more accurate analysis, and therefore would be even less conservative. EPA will recommend in guidance how these nonvulnerability determinations could be made.

If the system could not qualify by meeting any of the "natural disinfection" criteria, the system could still apply for a variance. But this would involve providing very site-specific information to the State to demonstrate that it is not vulnerable to virus contamination. For example, a comprehensive sanitary survey that includes an analysis of the hydrogeological characteristics would be required. This might include monitoring

of indicators for viruses such as coliphage or use of more sophisticated ground-water models than those generally provided by EPA.

Guidance for determining compliance with both "natural disinfection" criteria and variance criteria is now being developed by EPA and will be made available for public comment.

Variance Criteria: Since variances would apply only to source water disinfection, the variance criteria presented in the Draft Rule Criteria document relate only to source water vulnerabilities to contamination. Criteria that States might use to assess vulnerability of distribution systems would be placed in guidance, e.g., a cross-connection control program, and system design that would ensure a high probability that positive pressure is maintained throughout the distribution system.

Inclusion of *Legionella*: EPA is in the process of gathering information on the occurrence of *Legionella* in ground waters. Since it has not yet been clearly established that this organism occurs in ground water not under the direct influence of surface water, it may not be necessary to include coverage for this organism in the rule.

Level of Inactivation: The appropriate level of inactivation, to be specified either in the rule or in guidance, has not yet been determined. The Draft Rule Criteria document presents two possible requirements to reflect those possibilities: (1) meeting a specific level of "x"% inactivation and/or removal of viruses as determined by the State; or, (2) the State would determine what level would be adequate to ensure protection against viral contamination. Whether or not specific requirements such as the level of inactivation are given in the rule has a direct bearing on enforceability of the requirements. Any criteria left to State discretion would not be federally enforceable, but enforceable only by the State. If EPA decides to allow State discretion on this requirement, it will be because of (1) a belief by EPA that dramatic risks to water systems will not be an effect of State discretion and (2) a concern that many systems might otherwise be required to excessively disinfect. The results of the virus survey now under way will influence which option is selected.

Continuity of Disinfection: Requirements to maintain a 0.2 mg/l disinfectant residual or an ultraviolet (UV) dosage of "y" mW-sec/cm^2 at the entry point to the distribution system would be very similar to requirements in the SWTR. EPA believes that

specifying the monitoring and enforceable criteria in the rule as opposed to leaving this to State discretion has several advantages: transactional and administrative costs to States would be minimized, and federally enforceable, uniform criteria for all systems considered vulnerable to contamination could be applied.

Detectable Residual in the Distribution System: EPA will probably propose the maintenance of a detectable disinfectant residual in the distribution system, as opposed to a certain concentration of disinfectant residual, for the same reasons behind the SWTR distribution system requirements: (1) the absence of a distribution system residual in the distribution system, rather than the presence of a residual below some specific level, can serve as an indicator of potential contamination at a site; (2) the relationship between a specific concentration of disinfectant in the distribution system and the consequent level of protection provided is not well defined at this time; and (3) requiring systems to meet a specific residual (e.g., at least 0.2 mg/l) throughout the distribution system might result in systems having to augment their disinfection practices unnecessarily and, at the same time, increase the amount of disinfection by-products.

EPA recognizes that the absence of a disinfectant residual at a distribution system site does not necessarily indicate microbiological contamination; such contaminants simply may not be present, even in the absence of a disinfectant residual. In other words, if microbial populations are low, the lack of a disinfectant residual is not a concern. Therefore, sites with HPC populations of 500/ml or less would be considered equivalent to sites with detectable disinfectant residuals for purposes of determining compliance.

A definition of "detectable" disinfectant residual would be placed either in the rule or in guidance since the term could be interpreted in many different ways. For the SWTR, it was defined to mean concentrations ≥ the detection limits for each analytical method in Standard Methods, 16th Edition. A definition of "detectable" residual needs to take into account the problem of matrix interference (i.e., it should be applicable under field conditions) and the skill level of operators at water treatment plants conducting the analysis.

New Technologies: In response to public comments, allowance is made for emerging technologies such as UV disinfection and membrane processes in the source water disinfection requirements.

Analytical Methods: Analytical methods for measuring UV dosage at the entry point to the distribution system have not yet been developed. No UV methods are given in Standard Methods, 17th Edition.

Compliance: Considering the deadlines for determination of whether ground water is under the direct influence of surface water for community systems (June 29, 1994) and noncommunity systems (June 29, 1999) and the estimated date of rule promulgation (June 1995), EPA believes the proposed compliance dates for community and noncommunity systems in this rule are reasonable.